Time Table Scheduling Problem Using Fuzzy Algorithmic Approach

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Abstract

In this paper we develop an algorithm to generate a course Time table using fuzzy algorithmic approach satisfying certain constraints. With an example we show that how these constraints are satisfied.

Keywords: Time Tabling Problem, Fuzzy Algorithmic Approach, Fuzzy Membership Values.

1. INTRODUCTION

Time tabling problem exists since time immemorial. No academic Institute can function without a proper time table. Despite the problem being quite old, it is also a very challenging problem. Time tabling of an Institute depends to a large extent on the Institute and the various resources available in the Institute. Hence any attempt at developing a generic solution to the time tabling problem will come to naught. At the same time, it is also true that several papers [1] which deal with finding solutions to time tabling problem using various algorithms are appearing on a continuous basis.

Time tabling problem involves factors [2] such as teachers, classes and courses. Various resources are rooms, time slots etc. Time tabling problem is concerned with maximum utilization of the available resources subject to a set of constraints [3] and can be classified into three main classes namely school time tabling, course time tabling and examination time tabling.

In this paper, we have attempted to give solution to course time tabling problem based on algorithmic approach in which priorities of teachers for the various classes taught by them are considered using fuzzy membership values. Fuzzy set theory introduced by Prof. Lotfi A. Zadeh of Berkeley in 1965 as a means to model vagueness and ambiguity in complex systems is gaining more [4] and more popularity with every passing day. Today, practically there is no field in which fuzzy techniques do not play any role.

Ordinary sets (referred to as crisp sets) are applicable only in cases where there is absolute certainty. But our life is not full of certainties. In our every day life, we use vague terms such as old, young, short and tall more often than precise terms such as 75 years and 5 months, 22 years and 7 ½ months, 4′ 7″, 6′ 3″ etc. These terms are referred to as fuzzy terms.

Let X be a universal set. A fuzzy set A on X is characterized by a membership function μ_A which is a function from X to [0, 1]. For an element $x \in X$, if $\mu_A(x) = 0$, then $x \notin A$. If $\mu_A(x) = 1$, then $x \in A$. As $\mu_A(x)$ moves closer to 0, the chances that x belongs to A are lesser and lesser. As $\mu_A(x)$ moves away from 0 and closer to 1, the chances that x belongs to A are more and more. μ_A need not take only real values between 0 and 1. μ_A can assume fuzzy values such as low,

medium, high etc. In this paper, we generate time table by assigning membership grades for the priorities given by a teacher for different time slots.

We are assuming the following constraints. Nevertheless, the solutions we propose can be applied to general time tabling problem.

1. We assume that the number of semesters is three.
2. Six subjects are to be taught by different teachers for each semester.
3. Every teacher will be handling two subjects (of course, for different semester).
4. Each subject should be taught for four hours in a week.
5. Classes are held for seven hours from Monday to Friday and for four hours on Saturdays.

We note that the department requires totally nine teachers for teaching all the subjects and the department has to allocate time slots for 72 hours in a week.

2. FUZZY ALGORITHMIC APPROACH

In this approach, time table is generated by assigning membership grades for the priorities given by a teacher for different time slots. In our time tabling problem, we assume there are nine teachers T_1, T_2…T_9 who teach for three semesters S_1, S_2, S_3. Each teacher T_i teaches a subject for semester S_j for four periods in a week.

Suppose $(T_i, S_j, t_k) = h$. This means the degree to which teacher T_i takes class for semester S_j at time t_k is high. We can always find an r such that $7(r - 1) < k \leq 7r$. Then for any $p \neq j$ (in this example, there can be only one such p because any teacher teaches only two subjects), following conditions should hold good.

(i) $(T_i, S_j, t_k) = 0$ $(i \neq i)$ (Note that there are 5 more such i's corresponding to other five teachers for the class S_j)

(ii) $(T_i, S_p, t_k) = 0$. (Because it corresponds to the same slot for another semester for the same teacher).

(iii) $(T_i, S_p, t_{k-1}) = l$ (1 < k and k not congruent to 1 (mod 7)).

This means $k \neq 8, 15, 22, 29, 36$. Note that if $k = 8$, then $(T_i, S_j, t_8) = h$ does not mean $(T_i, S_p, t_7) = l$. This applies to k = 15, 22, 29 and 36. A teacher can take class on the first hour of a day and the last hour of the previous day.

(iv) $(T_i, S_p, t_{k+1}) = l$ ($k \leq 38$ and k not congruent to 0 (mod 7). This means k is not a multiple of 7 ie. $7(r - 1) < k < 7r$).

(v) $(T_i, S_p, t_{k-2}) = m$ ($2 < k$, k not congruent to 2 (mod 7) and k not congruent to1(mod 7) ie. $k \neq 8, 9, 15, 16, 22, 23, 29, 30, 36, 37$).

(vi) $(T_i, S_p, t_{k+2}) = m$ ($k \leq 37$ and k not congruent to 0 (mod 7) this means $7(r - 1) < k < 7r$. Also $(k + 1)$ not congruent to 0 (mod 7). This means $k \neq 6, 13, 20, 27, 34$).

(vii) $(T_i, S_p, t_{k-q}) = h$ ($k > 3$, $3 \leq q < k - 7(r - 1)$).

(viii) $(T_i, S_p, t_{k+q}) = h$ ($k \leq 36$, $k \leq 7r - 3$, $3 \leq q$).

First fix the time table for (T_1, S_1) by placing 1s in convenient locations. There should be four 1s in each row. If there is a 1 for a teacher, for a semester in one day, all other entries for that teacher for that semester for that day should be made 0s. In other words, a teacher teaches a subject for a given semester in a given day for maximum one hour. Some hs should ultimately be converted to 1s satisfying the above conditions. Then the final time table would have been generated.

We assume that every class lasts for one hour. Also on week days, classes start at 8 am and end at 12 noon for the morning session (4 hours). Again, classes start at 2 pm and end at 5 pm for the

afternoon session (3 hours). On Saturdays, classes are held only from 8 am to 12 noon. Thus there are 39 hours t_1, t_2,…....t_{39} where t_1 corresponds to 8 am to 9 am of Monday, t_7 corresponds to 4 pm to 5 pm of Monday, t_8 corresponds to 8 am to 9 am of Tuesday and finally t_{39} corresponds to 11 am to 12 noon of Saturday.

We now construct a matrix of size 18×39 as follows.
The first row of the matrix corresponds to (T_1, S_1). Last row corresponds to (T_9, S_2). The columns of the matrix correspond to t_1, t_2, t_3,……t_{39}. Note that for each teacher T_i $(1 \leq i \leq 9)$, there are two rows which correspond to the two semesters handled by T_i. We thus have an 18×39 matrix whose entries can be l which stands for low, m which stands for medium and h which stands for high. For example, if the degree to which teacher T_1 teaches semester S_1 at time t_1 is high, then we represent it by writing $(T_1, S_1, t_1) = h$.

2.1 Example 2.1
There are nine teachers T_1, T_2,…..T_9 and three semesters S_1, S_2 and S_3. Assume that teachers T_1, T_3, T_5 teach for semesters S_1 and S_3, teachers T_2, T_6, T_8 teach for semesters S_2 and S_3, teachers T_4, T_7, T_9 teach for semesters S_1 and S_2.

Suppose teacher T_1 teaches semester S_1 to a high degree when k takes the values 2, 10, 20, 26, 29, 39. Teacher T_2 teaches semester S_2 to a high degree when k takes the values 1, 10, 20, 26, 32, 37. T_3 teaches semester S_1 to a high degree when k takes the values 3, 11, 19, 28, 30, 36. T_4 teaches semester S_1 to a high degree when k takes the values 1, 9, 20, 25, 35, 37. T_5 teaches semester S_1 to a high degree when k takes the values 3, 13, 15, 23, 33, 39. Teacher T_6 teaches semester S_2 to a high degree when k takes the values 5, 8, 21, 27, 32, 38. Teacher T_7 teaches semester S_1 to a high degree when k takes the values 7, 11, 15, 27, 33, 37. Suppose teacher T_8 teaches semester S_2 to a high degree when k takes the values 2, 13, 21, 26, 29, 38. Teacher T_9 teaches semester S_1 to a high degree when k takes the values 1, 10, 21, 27, 33, 37. The entries of the matrix generated as follows.

For example, when T_1 teaches semester S_1 and k takes the value 2, enter $(T_1, S_1, t_2) = h$ which means T_1 teaches class S_1 to a high degree. Then $(T_3, S_1, t_2) = (T_4, S_1, t_2) = (T_5, S_1, t_2) = (T_7, S_1, t_2) = (T_9, S_1, t_2) = 0$. Also $(T_1, S_3, t_2) = 0$. Thus conditions (i) and (ii) are satisfied.

The value of r depends on the value of k. If the value of k is a multiple of 7 i,e when k takes the value 7, 14, 21, 28 and 35, $r = \lfloor k / 8 \rfloor + 1$. Otherwise, the value of r is $\lfloor k / 7 \rfloor + 1$. Here the value of k is 2 and is not a multiple of 7. So $r = \lfloor 2 / 7 \rfloor + 1 = 1$. Then for S_3, other entries are computed as follows.

$(T_1, S_3, t_1) = l$ because $(1 < 2$ and 2 not congruent to 1 (mod 7)) according condition (iii). $(T_1, S_3, t_3) = l$ because 2 is not a multiple of 7. ie. $0 < 2 < 7$ satisfying the condition (iv). $(T_1, S_3, t_4) = m$ because $(2 \leq 37$ and 2 not congruent to 0 (mod 7), satisfying the condition (v). $(T_1, S_3, t_5) = h$ because $(2 \leq 36, 2 \leq 4)$ satisfying the condition (vi) and the value of q is 3. Correspondingly, $(T_1, S_1, t_5) = 0$, $(T_1, S_1, t_6) = l$ $(T_1, S_1, t_4) = l$, $(T_1, S_1, t_7) = m$, $(T_1, S_1, t_3) = m$. All other values are made zéro i,e $(T_1, S_1, t_1) = 0$, $(T_1, S_3, t_6) = 0$, $(T_1, S_3, t_7) = 0$. Similarly generate entries for all the nine teachers for all the slots satisfying the conditions from (i) to (viii). For the above example, the matrix filled with ‘h’, ’m’ and ‘l’ is generated and is as shown in the table given in table below.

K varies	1 to 7	8 to 14	15 to 21	22 to 28	29 to 35	35 to 39
(T_1,S_1)	0hml0lm	00hml0l	ml0lmh0	l0lmh00	hml0lmh	0lmh
(T_1,S_3)	l0lmh00	ml0lmh0	00hml0l	mhml0mm	0lmhml0	hml0
(T_2,S_2)	hml0lmh	00hml0l	ml0lmh0	l0lmh00	000hml0	0h00
(T_2,S_3)	0lmhml0	ml0lmh0	00hml0l	mhml0lm	0ml0lmh	l0lm
(T_3,S_1)	00hml0l	m00hml0	l0lmh00	0ml0lmh	0hml0lm	hml0
(T_3,S_3)	ml0lmh0	0ml0lmh	0hml0lm	000hml0	l0lmhm0	0lmh
(T_4,S_1)	hml0lmh	0hml0lm	ml0lmh0	000hml0	0ml0lmh	0h00
(T_4,S_2)	0lmhml0	l0lmh00	00hml0l	mml0lmh	000hml0	l0lm
(T_5,S_1)	00hml0l	ml0lmh0	hml0lmh	0hml0lm	l0lmhm0	0lmh
(T_5,S_3)	ml0lmh0	00hmlml	0lmhml0	l0lmh00	0hml0lm	hml0
(T_6,S_2)	l0lmh00	hml0lmh	0ml0lmh	ml0lmh0	000hml0	00h0
(T_6,S_3)	0hml0mm	0lmhml0	000hml0	00hml0l	mml0lmh	ml0l
(T_7,S_1)	0ml0lmh	000hml0	hml0lmh	ml0lmh0	l0lmh00	0h00
(T_7,S_2)	000hml0	0ml0lmh	0lmhml0	00hml0l	mhml0lm	l0lm
(T_8,S_2)	0hml0lm	ml0lmh0	0ml0lmh	l0lmh00	hml0lmh	00h0
(T_8,S_3)	l0lmh00	00hml0l	m00hml0	0hml0mm	0lmhml0	ml0l
(T_9,S_1)	hml0lmh	00hml0l	mml0lmh	ml0lmh0	l0lmh00	0h00
(T_9,S_2)	0lmhml0	ml0lmh0	000hml0	00hml0l	mhml0lm	l0lm

TABLE 1. Matrix filled with 'h' 'm' and 'l'

Once the matrix is completed with all its entries, generate another matrix first by replacing all 'h' by '5' as shown in the table given below.

K varies	1 to 7	8 to 14	15 to 21	22 to 28	29 to 35	35 to39
(T_1, S_1)	0500000	0050000	0000050	0000500	5000005	0005
(T_1, S_3)	0000500	0000050	0050000	0500000	0005000	5000
(T_2, S_2)	5000005	0050000	0000050	0000500	0005000	0500
(T_2, S_3)	0005000	0000050	0050000	0500000	0000005	0000
(T_3, S_1)	0050000	0005000	0000500	0000005	0500000	5000
(T_3, S_3)	0000050	0000005	0500000	0005000	0000500	0005
(T_4, S_1)	5000005	0500000	0000050	0005000	0000005	0500
(T_4, S_2)	0005000	0000500	0050000	0000005	0005000	0000
(T_5, S_1)	0050000	0000050	5000005	0500000	0000500	0005
(T_5, S_3)	0000050	0050000	0005000	0000500	0500000	5000
(T_6, S_2)	0000500	5000005	0000005	0000050	0005000	0050
(T_6, S_3)	0500000	0005000	0005000	0050000	0000005	0000
(T_7, S_1)	0000005	0005000	5000005	0000050	0000500	0500
(T_7, S_2)	0005000	0000005	0005000	0050000	0500000	0000
(T_8, S_2)	0500000	0000050	0000005	0000500	5000005	0050
(T_8, S_3)	0000500	0050000	0005000	0500000	0005000	0000
(T_9, S_1)	5000005	0050000	0000005	0000050	0000500	0500
(T_9, S_2)	0005000	0000050	0005000	0050000	0500000	0000

TABLE 2. 'h' replaced by '5'

Next step is to generate a matrix in which each row will have four selected periods. The entries which satisfy the following conditions are changed from '5' to '2' to indicate that they are selected periods.

(1) Maximum one class in a day for the same subject.
(2) Maximum one 8 - 9 class in a week for each subject.
(3) Ultimately, there should be only four selected periods in any row.

As an entry is changed from '5' to '2' in a row, corresponding time slot for the same teacher for other semester (to which he teaches) is made zero indicating that he is not available for that semester during that time slot. Corresponding time slot for each of the other teachers who are teaching for the same semester is made zero indicating that the particular class is not free for any of them.For example if (T_1, S_1, t_2) is changed from '5' to '2' then entry corresponding to (T_1, S_3, t_2) is made zero. And also entries corresponding to (T_3, S_1, t_2), (T_4, S_1, t_2), (T_5, S_1, t_2), (T_7, S_1, t_2) and (T_9, S_1, t_2) are all made zeros. This time Matrix generated is as shown in the table given in table 3.

K varies	1 to 7	8 to 14	15 to 21	22 to 28	29 to 35	35 to 39	No of SP
(T_1, S_1)	0200000	0020000	0000020	0000200	0000000	0000	4
(T_1, S_3)	0000200	0000020	0020000	0200000	0000000	0000	4
(T_2, S_2)	2000000	0020000	0000020	0000200	0000000	0000	4
(T_2, S_3)	0002000	0000000	0000000	0000000	0000002	0000	2
(T_3, S_1)	0020000	0002000	0000200	0000002	0000000	0000	4
(T_3, S_3)	0000020	0000002	0000000	0002000	0000200	0000	4
(T_4, S_1)	2000000	0200000	0000000	0002000	0000002	0000	4
(T_4, S_2)	0002000	0000200	0020000	0000002	0000000	0000	4
(T_5, S_1)	0000000	0000020	2000000	0200000	0000200	0000	4
(T_5, S_3)	0000000	0020000	0002000	0000200	0200000	0000	4
(T_6, S_2)	0000200	2000000	0000002	0000000	0002000	0000	4
(T_6, S_3)	0200000	0002000	0000000	0020000	0000000	0000	3
(T_7, S_1)	0000002	0000000	0000002	0000000	0000000	0200	3
(T_7, S_2)	0000000	0000002	0000000	0020000	0200000	0000	3
(T_8, S_2)	0200000	0000020	0000000	0000000	2000000	0020	4
(T_8, S_3)	0000000	0000000	0000000	0000000	0002000	0000	1
(T_9, S_1)	0000000	0000000	0000000	0000020	0000000	0000	1
(T_9, S_2)	0000000	0000000	0002000	0000000	0000000	0000	1

TABLE 3. Selected periods are replaced by '2'

If the number of selected periods in any of the rows is not equal to 4**,** then replace 'h' as well as 'm' by '4' in such a row**.** For the above example, in 4^{th}, 12^{th}, 13^{th}, 14^{th}, 16^{th}, 17^{th} and 18^{th} row, the number of selected periods are 2, 3, 3, 3, 1, 1 and 1 respectively. Hence in those rows, both 'h' and 'm' are replaced by '4' as shown in the table given below.

K varies	1 to 7	8 to 14	15 to 21	22 to 28	29 to 35	35 to 39
(T_1, S_1)	0500000	0050000	0000050	0000500	5000005	0005
(T_1, S_3)	0000500	0000050	0050000	0500000	0005000	5000
(T_2, S_2)	5000005	0050000	0000050	0000500	0005000	0500
(T_2, S_3)	0044400	4000440	0044000	4440004	0400044	0004
(T_3, S_1)	0050000	0005000	0000500	0000005	0500000	5000
(T_3, S_3)	0000050	0000005	0500000	0005000	0000500	0005
(T_4, S_1)	5000005	0500000	0000050	0005000	0000005	0500
(T_4, S_2)	0005000	0000500	0050000	0000005	0005000	0000
(T_5, S_1)	0050000	0000050	5000005	0500000	0000500	0005
(T_5, S_3)	0000050	0050000	0005000	0000500	0500000	5000
(T_6, S_2)	0000500	5000005	0000005	0000050	0005000	0050
(T_6, S_3)	0440044	0044400	0004400	0044000	4400044	4000
(T_7, S_1)	0400044	0004400	4400044	4000440	0004400	0400
(T_7, S_2)	0004400	0400044	0044400	0044000	4440004	0004
(T_8, S_2)	0500000	0000050	0000005	0000500	5000005	0050
(T_8, S_3)	0004400	0044000	4004400	0440044	0044400	4000
(T_9, S_1)	4400044	0044000	4400044	4000440	0004400	0400
(T_9, S_2)	0044400	4000440	0004400	0044000	4440004	0004

TABLE 4: 'h' and 'm' are replaced by '4' in rows where SP not equal to 4

Once again generate matrix of selected periods which satisfy the constraints in section 2 by selecting and replacing 5s and 4s by 2s as shown in the table given below.

K Varies	1 to 7	8 to 14	15 to 21	22 to 28	29 to 35	35 to 39	No of SP
(T_1, S_1)	0200000	0020000	0000020	0000200	0000000	0000	4
(T_1, S_3)	0000200	0000020	0020000	0200000	0000000	0000	4
(T_2, S_2)	2000000	0020000	0000020	0000200	0000000	0000	4
(T_2, S_3)	0020000	0000200	0002000	2000000	0000000	0000	4
(T_3, S_1)	0020000	0002000	0000200	0000002	0000000	0000	4
(T_3, S_3)	0000020	0000002	0000000	0002000	0000200	0000	4
(T_4, S_1)	2000000	0200000	0000000	0002000	0000002	0000	4
(T_4, S_2)	0002000	0000200	0020000	0000002	0000000	0000	4
(T_5, S_1)	0000000	0000020	2000000	0200000	0000200	0000	4
(T_5, S_3)	0000000	0020000	0000000	0000200	0200000	2000	4
(T_6, S_2)	0000200	0000002	0000000	0000020	0002000	0000	4
(T_6, S_3)	0200000	0002000	0000200	0020000	0000000	0000	4
(T_7, S_1)	0000020	0000200	0200000	0000000	0002000	0000	4
(T_7, S_2)	0000000	0200000	0002000	0020000	2000000	0000	4
(T_8, S_2)	0200000	0000020	0000002	0000000	0000002	0000	4
(T_8, S_3)	0002000	0000000	2000000	0000020	0020000	0000	4
(T_9, S_1)	0000002	0000000	0000002	0000000	0000000	0200	3
(T_9, S_2)	0020000	0000000	0000200	0002000	0000000	0002	4

TABLE 5: Selected periods are replaced by '2'

If the number of selected periods in any of the rows is not equal to four**,** then once again replace 'h', 'm' as well as 'l' by "3" in such a row**.** For the above example, the number of selected periods is three in 17th row. Hence in that row h', 'm' and 'l' are replaced by "3". This is illustrated in the table given below.

K varies	1 to 7	8 to 14	15 to 21	22 to 28	29 to 35	35 to 39
(T_1, S_1)	0550005	0055000	5000550	0005500	5500055	0055
(T_1, S_3)	0000500	0000050	0050000	0500000	0005000	5000
(T_2, S_2)	5000005	0050000	0000050	0000500	0005000	0500
(T_2, S_3)	0044400	4000440	0044000	4440004	0400044	0004
(T_3, S_1)	0050000	0005000	0000500	0000005	0500000	5000
(T_3, S_3)	0000050	0000005	0500000	0005000	0000500	0005
(T_4, S_1)	5000005	0500000	0000050	0005000	0000005	0500
(T_4, S_2)	0005000	0000500	0050000	0000005	0005000	0000
(T_5, S_1)	0050000	0000050	5000005	0500000	0000500	0005
(T_5, S_3)	0000050	0050000	0005000	0000500	0500000	5000
(T_6, S_2)	0000500	5000005	0000005	0000050	0005000	0050
(T_6, S_3)	0440044	0044400	0004400	0044000	4400044	4000
(T_7, S_1)	0400044	0004400	4400044	4000440	0004400	0400
(T_7, S_2)	0004400	0400044	0044400	0044000	4440004	0004
(T_8, S_2)	0500000	0000050	0000005	0000500	5000005	0050
(T_8, S_3)	0004400	0044000	4004400	0440044	0044400	4000
(T_9, S_1)	3330333	0033303	3330333	3303330	3033300	0300
(T_9, S_2)	0044400	4000440	0004400	0044000	4440004	0004

TABLE 6. 'h' 'm' and 'l' are replaced by '3' in rows where SP not equal to 4

Once again generate matrix of selected periods which satisfy the constraints in section 2 by selecting and replacing 5s, 4s and 3s by 2s as shown in the table given below.

K varies	1 to 7	8 to 14	15 to 21	22 to 28	29 to 35	35 to39	No Of SP
(T1,S1)	0200000	0020000	2000000	0002000	0000000	0000	4
(T1,S3)	0000200	0000020	0020000	0200000	0000000	0000	4
(T2,S2)	2000000	0020000	0000020	0000200	0000000	0000	4
(T2,S3)	0020000	0000200	0002000	2000000	0000000	0000	4
(T3,S1)	0020000	0002000	0000200	0000002	0000000	0000	4
(T3,S3)	0000020	0000002	0000000	0002000	0000200	0000	4
(T4,S1)	2000000	0200000	0000020	0000000	0000002	0000	4
(T4,S2)	0002000	0000200	0020000	0000002	0000000	0000	4
(T5,S1)	0000000	0000020	0000002	0000000	0000200	0002	4
(T5,S3)	0000000	0020000	0000000	0000200	0200000	2000	4
(T6,S2)	0000200	0000002	0000000	0000020	0002000	0000	4
(T6,S3)	0200000	0002000	0000200	0020000	0000000	0000	4
(T7,S1)	0000020	0000200	0200000	2000000	0000000	0000	4
(T7,S2)	0000000	0200000	0002000	0020000	2000000	0000	4
(T8,S2)	0200000	0000020	0000002	0000000	0000002	0000	4
(T8,S3)	0002000	0000000	2000000	0000020	0020000	0000	4
(T9,S1)	0000200	0000002	0000000	0200000	2000000	0000	4
(T9,S2)	0020000	0000000	0000200	0002000	0000000	0002	4

TABLE 7. Selected periods are replaced by '2'

The number of selected periods is equal to **four** in all the rows indicating that it is possible to generate Time table for the given set of priorities satisfying the constraints mentioned in section 1. Finally, the Time table is generated for all the three semesters by indicating the time slot assigned for each teacher. This is shown in the Table given below.

Semester 1

Days	ses1	ses2	ses3	ses4	ses5	ses6	ses7
Mon	T_4	T_1	T_3	–	T_9	T_7	–
Tue	–	T_4	T_1	T_3	T_7	T_5	T_9
Wed	T_1	T_7	–	–	T_3	T_4	T_5
Thurs	T_7	T_9	–	T_1	–	–	T_3
Fri	T_9	–	–	–	T_5	–	T_4
Sat	–	–	–	T_5			

Semester 2

Days	ses1	ses2	ses3	ses4	ses5	ses6	ses7
Mon	T_2	T_8	T_9	T_4	T_6	–	–
Tue	–	T_7	T_2	–	T_4	T_8	T_6
Wed	–	–	T_4	T_7	T_9	T_2	T_8
Thurs	–	–	T_7	T_9	T_2	T_6	T_4
Fri	T_7	–	T_9	T_6	–	–	T_8
Sat	–	–	–	–			

Semester 3

Days	ses1	ses2	ses3	ses4	ses5	ses6	ses7
Mon	–	T_6	T_2	T_8	T_1	T_3	–
Tue	–	–	T_5	T_6	T_2	T_1	T_3
Wed	T_8	–	T_1	T_2	T_6	–	–
Thurs	T_2	T_1	T_6	T_3	T_5	T_8	–
Fri	–	T_5	T_8	–	T_3	–	–
Sat	T_5	–	–	–			

TABLE 8: Final Time table generated for example 2.1

3. CONCLUSION

Time table generated using Algorithmic approach always ensures a gap of at least one hour between two classes for a teacher in a day. All other constraints like four hours for each subject in a week, only one first hour slot for a teacher for a given subject in a week and at most one hour class in a day for a teacher for a given subject etc can be implemented by specifying proper conditions in the program.

4. REFERENCES

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